NDIDATE'S NUMBER

or the use of the Department only)

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Physics 30
1968

DEPARTMENT
EDUCATION ALBERTA

HIGH SCHOOL AND UNIVERSITY MATRICULATION
EXAMINATIONS BOARD

DEPARTMENTAL EXAMINATIONS, 1968

PHYSICS 30

Time — 2 hours.

Total Possible Mark — 101.

DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.
READ THE QUESTIONS CAREFULLY.

Mathematical tables, slide rules and geometry sets may be used.

Answers to questions 1 to 22, inclusive, will be machine scored. Record your answers on the separate answer sheet provided. Since these questions are not of equal length or difficulty the available time must be budgeted wisely. Answers to questions 23 to 29, inclusive, are to be recorded in this booklet.

Rough and finished work may be done in either soft pencil or blue or black ink (pen or ballpoint).

DO NOT FOLD THIS BOOKLET.

Place your test booklet in the answer envelope in such a way that the UPPER LEFT-HAND CORNER OF THE BOOKLET (Candidate's Number) shows through the SLASHED CORNER of the answer envelope.

BE SURE TO SEAL THE ENVELOPE.

Constants:

$g = 980$ cm/sec^2 or 32 ft/sec^2
$J = 4.2$ joules/cal or 778. ft lb wt/BTU
1 H.P. = 550 ft lb wt/sec or 746 watts
Specific heat for aluminum = 0.20
Latent heat of fusion of ice = 80 cal/gm
Specific heat of ice = 0.50
1 Faraday of Charge = 96,500 coulombs

Machine Score

Booklet Score

TOTAL

(For the use of Sub-examiners only)

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ROUGH WORK ONLY

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Questions 1 to 22 inclusive, have a value of two marks each. In each case select the BEST of the four answers and record your choice on the SEPARATE ANSWER SHEET provided.

EXAMPLE	ANSWERS	ANSWER SHEET
If an object has a speed of 4 ft/sec how far will it travel in 2 seconds?	A. 4 ft B. 8 ft C. 6 ft D. 10 ft	A ☐ B ■ C ☐ D ☐ E ☐ DISREGARD COLUMN "E" ON ANSWER SHEET.

You are to use an ORDINARY HB PENCIL to mark your answers on the answer sheet. Make certain your answer marks are heavy and black. If you change your mind about a question, it is essential that you erase your first mark completely. There should be only one answer marked for each question. Be sure there are no stray pencil marks on your answer sheet.

1. An object has its velocity changed from 15 mph to 60 mph in 5 min. Find the acceleration in ft/sec/sec.

1.
A. 15.1 ft/sec/sec
B. 13.2 ft/sec/sec
C. 0.22 ft/sec/sec
D. 1.42 ft/sec/sec

2. A force of 10 lb wt acts on a 64 lb object for 10 sec. If the initial velocity of the object was 14 ft/sec in a direction opposite to the applied force find the final velocity.

2.
A. 36 ft/sec
B. 64 ft/sec
C. 50 ft/sec
D. 24 ft/sec

3. A force of 100 gm wt acts on an object causing it to move 2,000 cm in 10 sec. Find the work done in joules.

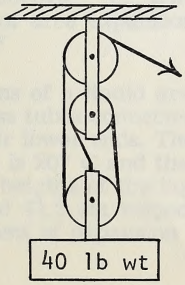
3.
A. 39.2 joules
B. 0.4 joules
C. 2×10^{-2} joules
D. 19.6 joules

4. An object has a kinetic energy of 320 ft pdl. What is the maximum distance it could move an object on a horizontal surface which has a retarding force of friction of 2 lb wt?

4.
A. 5 ft
B. 160 ft
C. 80 ft
D. 10 ft

5. If each pulley weighs 5 lb wt, calculate the efficiency of the machine. Neglect friction.

5.
A. 100%
B. 88.9%
C. 80%
D. 66.7%



ROUGH WORK ONLY
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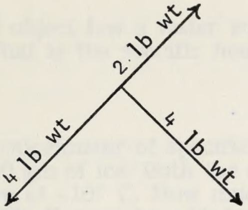
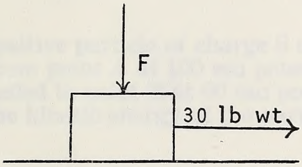
6. An object is held in equilibrium by the action of four forces, three of which are shown in the diagram. Find the magnitude of the force not shown in the diagram.



6.
A. $\sqrt{20}$ lb wt
B. $\sqrt{8}$ lb wt
C. $\sqrt{10}$ lb wt
D. $\sqrt{12}$ lb wt

7. A force of 30 lb wt causes a 50 lb object to slide with constant velocity when the vertical force F is 100 lb wt. Find the coefficient of sliding friction.



7.
A. 0.33
B. 0.20
C. 0.60
D. 0.45

8. A rectangular tank 40 cm long, 20 cm wide, and 50 cm deep is filled with a liquid of specific gravity 1.4. Calculate the total force on one of the larger sides.

8.
A. 140,000 gm wt
B. 50,000 gm wt
C. 70,000 gm wt
D. 35,000 gm wt

9. A 2500 gm metal tank has a length of 40 cm, a width of 15 cm and a height of 10 cm. If the tank is floated in water how many litres of a liquid of specific gravity 1.6 can be poured into the tank before it sinks?

9.
A. 5.0 litres
B. 4.3 litres
C. 1.6 litres
D. 2.2 litres

10. If the coefficient of linear expansion of brass is 0.000018/° C. What is its coefficient of area expansion per degree Fahrenheit?

10.
A. 0.000020/° F
B. 0.000065/° F
C. 0.000010/° F
D. 0.000030/° F

11. Two columns of a liquid are balanced in vertical glass tubes connected by a horizontal tube at their lower ends. The temperature of one column is 20° C and that of the other is 60° C. The heights of the liquid columns are 40.0 cm and 41.2 cm respectively. Calculate the coefficient of expansion for this liquid.

11.
A. 0.00030/° C
B. 0.00075/° C
C. 0.00019/° C
D. 0.00068/° C

ROUGH WORK ONLY
(No marks given for work in this space)

12. Air is pumped into a 40 litre container. What volume of air at standard pressure and 17° C must be pumped into the container to produce a pressure of 1.5 atmospheres if the temperature increases to 27° C in the container.

12.
A. 37.8 litres
B. 27.6 litres
C. 46.3 litres
D. 58.0 litres

13. A 400 gm object has a water equivalent of 20 gm. What is the specific heat of the object?

13.
A. 0.50
B. 0.11
C. 0.02
D. 0.05

14. A 60 gm calorimeter of specific heat 0.10 contains 50 gm of ice. Both the calorimeter and ice are at –10° C. How much water at 90° C must be added to just melt the ice? The specific heat of ice is 0.50.

14.
A. 47.9 gm
B. 50.7 gm
C. 53.9 gm
D. 43.1 gm

15. An 8.4 gm object falls from a height of 300 meters. What is the maximum amount of heat that could be produced?

15.
A. 0.60 cal
B. 2.47 cal
C. 5.88 cal
D. 3.26 cal

16. A small positive particle of charge 6 esu is released from point A at 100 esu potential and is repelled to point B at 60 esu potential. What is the kinetic energy of the particle at point B?

16.
A. 600 erg
B. 240 erg
C. 360 erg
D. 580 erg

17. Determine the least amount of zinc which must be placed in a dry cell in order that it may supply an average current of 0.1 amp for 100 hr. Atomic weight of Zn^{++} is 65.

17.
A. 24.2 gm
B. 6.2 gm
C. 18.1 gm
D. 12.1 gm

18.

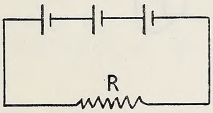


Fig. 1

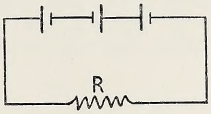


Fig. 2

Three identical cells of EMF 1.5 volts and negligible internal resistance are connected as shown in Fig 1 and produce a current of 0.5 amp in resistor R. Calculate the current these same three cells would produce in the same resistor R if connected as shown in Fig 2.

18.
A. $\frac{1}{2}$ amp
B. $\frac{1}{3}$ amp
C. $\frac{1}{6}$ amp
D. $\frac{1}{9}$ amp

ROUGH WORK ONLY

(No marks given for work in this space)

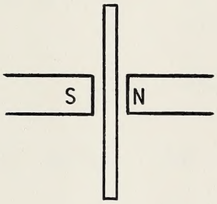
19. A dry cell develops 1.6 volts across its terminals when on open circuit. When a 5 ohm resistor is connected across the terminals the voltage between the terminals is 1.4 volts. Calculate the internal resistance of the cell.

19. A. 0.83 ohm
B. 0.71 ohm
C. 1.20 ohm
D. 0.63 ohm

20. A dry cell has an output voltage of 1.2 volts and can deliver a current of one ampere for 2 hr. What is its output energy in joules?

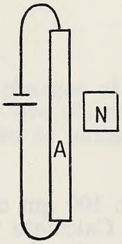
20. A. 4.4 joules
B. 144 joules
C. 8,640 joules
D. 4,760 joules

21. If the electrons are to flow up the wire, the wire must be moved



21. A. towards you
B. away from you
C. upwards
D. downwards

22. If the current flows up the wire A the free north pole (N) would move

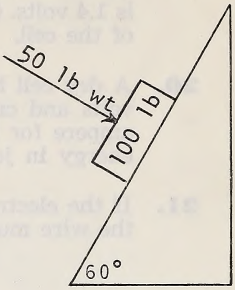


22. A. towards you
B. away from you
C. upwards
D. downwards

Values

In questions 23 to 29 COMPLETE SOLUTIONS must be shown in the spaces provided.

7 **23.** A 100 lb rectangular solid rests on an inclined plane. A force of 50 lb wt is incident on the object as shown in the diagram. If the coefficient of sliding friction is 0.20 calculate the acceleration with which the object slides down the plane.

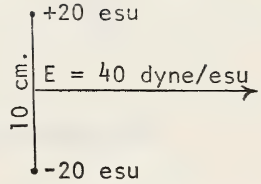


6 **24.** Sixty grams of ice at the melting point are added to 100 gm of water at 20° C contained in a 60 gm calorimeter of specific heat 0.20. Calculate the amount of ice and water left in the calorimeter after thermal equilibrium has been attained.

Values

6 **25.** A car of mass 3000 lb reaches the bottom of a hill at 64 ft/sec. The car then coasts up the hill coming to rest in a distance of 96 ft as measured along the road. If the hill can be represented by an inclined plane with an angle of 30° to the horizontal, calculate the number of ft lb wt of mechanical energy lost in bringing the car to rest.

26. Two point charges of +20 esu and –20 esu of charge respectively are placed in a uniform electric field of 40 dynes/esu as indicated in the diagram.



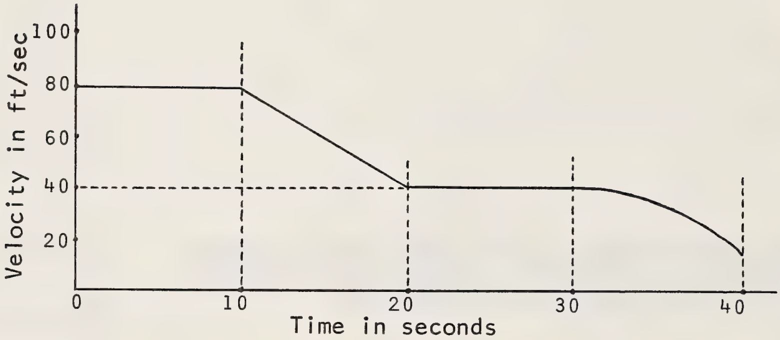
4 (a) Calculate the magnitude and direction of the force on each charge.

3 (b) Calculate the moment of the couple produced by the two forces.

Values

8 **27.** A diesel engine consumes 0.50 lb of fuel oil per minute. The heat of combustion of the oil is 24,000 BTU/lb. If the overall efficiency of the engine is 25% calculate the out-put horsepower developed by the engine.

28.



The diagram shows a velocity time graph for 20 lb object.

1 (a) For how many seconds, if any, was the object at rest?

2 (b) How far did the object travel in 30 seconds?

2 (c) What was the kinetic energy of the object at t = 25 seconds?

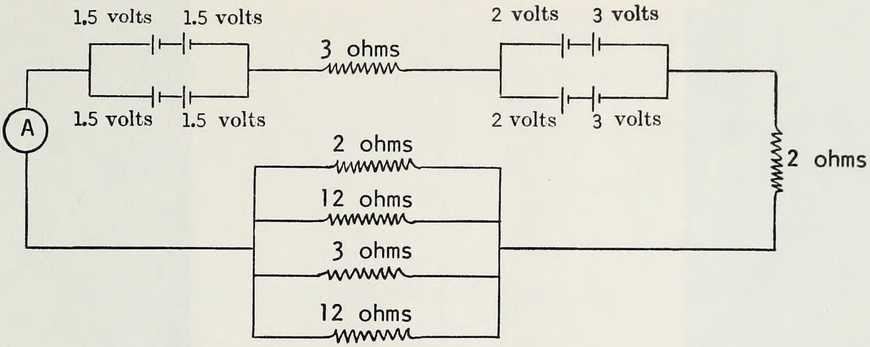
2 (d) What was the average velocity during the first 20 seconds?

2 (e) What was the momentum of the object at t = 15 seconds?

2 (f) What was the acceleration at t = 35 seconds?

Values

29. In the following diagram each cell has an internal resistance of 1 ohm.



3 (a) What is the total EMF?

4 (b) What current flows through the ammeter A?

5 (c) Calculate the heat generated by one of the 12 ohm resistors in a time of 10 seconds.

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